

DRAFT ENVIRONMENTAL ASSESSMENT

GYPSY MOTH SUPPRESSION PROGRAM, 2000

**CUYAHOGA VALLEY NATIONAL RECREATION AREA
NATIONAL PARK SERVICE
U.S. DEPARTMENT OF THE INTERIOR**

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Recommended:

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1. PURPOSE AND NEED FOR ACTION

1.1. Summary of Proposed Action

The natural, cultural, recreational and scenic values of Cuyahoga Valley National Recreation Area are at risk due to gypsy moth defoliation. This Environmental Assessment examines management options for suppression of the gypsy moth populations in Spring 2000. Any proposed suppression activities in subsequent years will be evaluated in a separate Environmental Assessment that will be made available for public review.

1.2. Park Purpose and Significance

Congress created Cuyahoga Valley National Recreation Area (CVNRA) in 1974 to preserve and protect natural, cultural and scenic resources for the recreational use and enjoyment of present and future generations. CVNRA is a National Park unit encompassing over 33,000 acres of relatively undeveloped land along 20 miles of the Cuyahoga River between the metropolitan areas of Cleveland and Akron, Ohio. Within the legislative boundary, the National Park Service (NPS) owns approximately 18,000 acres. The remainder of land is under management by other public or quasi-public entities or remains in private ownership. The resources of CVNRA are protected under the authorities of the National Park Service Organic Act of 1916 and Public Law 93-555.

The park harbors more than 19,000 acres of forest, most of which is susceptible to gypsy moth defoliation, including oak-hickory, maple-oak, oak-beech-maple, hemlock-beech, pine-spruce and maple-sycamore forest types. Oak-type forests, the most highly preferred host type for gypsy moths comprise approximately 70% of forest cover. Approximately 12,000 acres of forests susceptible to gypsy moths are federally owned. Other major habitats within the park include old field/scrub, agricultural fields, wetlands, and suburban lands.

CVNRA receives more than 3.5 million visits annually, with the highest visitation occurring during the spring, summer and fall months. The park contains many important recreational facilities, including the Ohio & Erie Canal Towpath Trail, over 100 miles of additional trails, several day use areas, two visitor centers, and an environmental education center.

1.3. Park Management Objectives

Guidance on overall management objectives and management policies for CVNRA are provided in the National Park Service's Management Policies (USDI, National Park Service 1988), Natural Resources Management Guideline (USDI, National Park Service 1991) and the park-specific General Management Plan (USDI, National Park Service 1977). Much of this guidance relates directly to the management of exotic (non-native) species. All cited policies are in accordance with Executive Order 13112.

It is NPS policy that "management of populations of exotic plant and animal species, up to and including eradication, will be undertaken wherever such species threaten park

resources or public health...High priority will be given to the management of exotic species that have a substantial impact on park resources and that can reasonably be expected to be successfully controlled.” (4:12) (USDI, National Park Service 1988).

Furthermore, parks are advised that “control or eradication will be undertaken, where feasible, if exotic species threaten to alter natural ecosystems; seriously restrict prey on or compete with native populations; present a hazard to human health or safety; cause a major scenic or aesthetic intrusion... or threaten resources or cause a health hazard outside the park.” (2:289) (USDI, National Park Service 1991).

The objectives and policies developed specifically for CVNRA that are directly significant to the management of the gypsy moth include:

“To preserve natural park lands under the concept of ‘total environment’ or ecosystems perpetuation and ensure that all visitor-use activities are appropriate to their setting;

To cooperate with federal, state, and local agencies in the monitoring of environmental quality; and

To provide for the safety and protection of visitors, residents and employees.”
(USDI, National Park Service 1977)

One specific policy developed from these objectives states that “noxious or exotic plant and animal species will be controlled or eradicated when deemed undesirable because of danger to public health, safety, or recreational use and enjoyment, or when their presence prevents fulfillment of the requirements of the enabling legislation.” (USDI, National Park Service 1977). The gypsy moth is an exotic species that has the potential to adversely affect healthy functioning ecosystems and public recreation at CVNRA.

To further develop resource management objectives for the park, a Resources Management Plan has been written (USDI, National Park Service 1999a). This plan includes park specific goals and objectives. One goal specific to the management of exotic pests states that “Integrated Pest Management (IPM) practices should encourage allowing natural controls to prevent pests from causing intolerable problems for humans, the developed environment, and natural ecosystems.” This objective characterizes the importance of utilizing and preserving natural controls when addressing exotic species issues.

Parks are advised that for widespread exotic species, control programs may need to take a regional approach that may involve other landowners (2:291) (USDI, National Park Service 1991). The monitoring and management of the natural resources of the Cuyahoga Valley region has always been a cooperative effort between numerous agencies and private landholders. Issues such as the gypsy moth infestation cross ownership and political boundaries and underscore the need for cooperative approaches. Efforts to suppress or control the gypsy moth in isolation will be less effective because gypsy moth caterpillars can migrate into treatment areas from adjacent untreated areas.

1.4. Project Objectives

Our project objectives for the management stated simply include:

- To reduce the long-term impacts of defoliation to the forest ecosystem and its components.
- To protect the recreational and scenic values of developed visitor use areas and trails from the impacts of defoliation.
- To cooperate with federal, state and local agencies on the suppression of gypsy moths on the lands in and adjacent to CVNRA.
- To provide for the health and safety of visitors, residents and employees.
- To preserve natural controls of gypsy moths whenever feasible.
- To implement pest management strategies which are effective and present the lowest risk to people, park resources and the environment.

1.5. Authorizing Laws and Policies

The following laws and policies provide the legal framework authorizing funding and specifying procedures for conducting gypsy moth management activities on federal lands.

The Cooperative Forestry Assistance Act of 1978 provides the authority for federal (U.S. Department of Agriculture) and other agency cooperation in management of forest insects and diseases.

The federal Insecticide, Fungicide and Rodenticide Act of 1947 requires that all insecticides used in suppression and eradication projects be registered with the U.S. Environmental Protection Agency and follow application requirements.

The National Environmental Policy Act of 1969, as amended, requires detailed and documented environmental analysis of proposed federal actions that may affect the quality of the human environment.

The Endangered Species Act of 1978, as amended, prohibits federal actions from jeopardizing the existence of federally listed threatened or endangered species or adversely affecting designated critical habitat. Federal agencies must consult with the U.S. Fish and Wildlife Service to determine the potential for adverse effects. Federal agencies are also responsible for improving the status of listed species.

The National Historic Preservation Act of 1966, as amended, recommends that federal agencies proposing action consult with the State Historic Preservation Officer regarding the existence and significance of cultural and historical resource sites.

Executive Orders 11988 and 11990 require that federal agencies shall attempt to avoid adversely impacting wetlands or floodplains in meeting objectives. Federal agencies adversely impacting wetlands or floodplains based on an environmental assessment and finding of no significant impact (FONSI) shall release the FONSI for public review (usually 30 days) prior to implementation of proposed actions.

Executive Order 13112 requires that federal agencies act to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause.

Decisions regarding gypsy moth management are made in full consideration of other relevant policies and procedures, including the 1995 FEIS. The USDA has determined through the FEIS and the Record of Decision (signed January 1996), that an environmental assessment, rather than a more comprehensive Environmental Impact Statement, is adequate for the proposed project. The Record of Decision selected Alternative 6 of the FEIS, supporting funding for the three alternatives (i.e., suppression, eradication, and slow the spread) for management of the gypsy moth. Approval for funding of this proposed project has been granted by the Forest Service, based on surveys and a biological evaluation conducted for the park (USDA, Forest Service 1999). This Environmental Assessment is tiered off the FEIS and Record of Decision (ROD) and documents the site-specific evaluation of the gypsy moth situation at CVNRA.

1.6. How the Gypsy Moth Affects the Environment

The gypsy moth (*Lymantria dispar*), a native of Europe, was introduced into North America around 1869 near Boston, Massachusetts. Since that time the moth has become established and has spread throughout the Northeastern United States, into Ohio and Michigan, and further south into Virginia.

Gypsy moth larvae are voracious defoliators. They prefer oaks, but will also consume dozens of other tree and shrub species to varying degrees including such CVNRA resources as basswood, boxelder, sweetgum, willow, maple, hickory, beech and dogwood. In Ohio, the larval or caterpillar life stage of the gypsy moth emerges from egg masses in late-April to early May. In order to develop, larvae go through 5-6 molts or stages (instars) shedding skin as they increase in size. First instar larvae do not feed upon hatching. Young larvae make their way up into the tree canopy where they produce silken threads that enable them to disperse on wind currents. Larvae then feed on leaves through much of June, consuming increasingly large amounts of foliage. By late-June, defoliation damage is most apparent. Fully developed caterpillars then go through a two-week pupation stage. Adult moths begin to emerge in numbers by late-July to early August, at which time brown male moths can be seen flying during the day seeking females. Female moths are white and do not fly but attract male moths by releasing a powerful sex attractant, or pheromone. After mating, each female lays one egg mass containing 100-

1,000 eggs. The mass is coated with hairs from her abdomen. These egg masses remain on the trees, rocks or whatever surface they are deposited through the winter unless consumed, removed or killed by various agents.

The impacts on people and the environment caused by gypsy moths are well documented. A broad spectrum of impacts have been identified and summarized in the document Gypsy Moth Management in the United States, A Cooperative Approach: 1995 Final Environmental Impact Statement (USDA, Forest Service 1995). As this environmental assessment (EA) is tiered off of that Final Environmental Impact Statement (FEIS), only a brief overview of these impacts follows.

Defoliation directly affects trees by decreasing their health and vigor. This can result in an increased susceptibility to disease and parasites, leading to increased tree mortality. Defoliation and the loss of mature trees can change forest and understory composition, water quality in streams and lakes, and food and habitat quality and availability for both terrestrial and aquatic wildlife. This can result in changes in the abundance and distribution of wildlife. Since the gypsy moth is a non-native species, its known and unknown effects on the environment are not part of natural ecological processes and are therefore largely undesirable.

Gypsy moths also present aesthetic, safety, and health concerns to employees and the public. Large stands of defoliated or dead trees can impact scenic values and present hazardous tree conditions along roadsides. Large numbers of caterpillars and their frass (droppings) can be a nuisance, affecting outdoor recreational experiences. Forest fire hazard levels can be increased with defoliation and tree mortality. Dead trees themselves are safety hazards for park visitors. Some individuals that are exposed to the hairs on gypsy moth larvae may develop skin rashes or irritations and allergies.

1.7. Gypsy Moth Monitoring in CVNRA

The CVNRA gypsy moth monitoring program began in 1987 with the placement of pheromone traps at over 200 sites using a 1/2-mile grid across the park. These traps contain a pheromone strip to attract flying male moths and a small insecticide strip. From 1987 through 1992, the average number of male moths caught in each trap increased from 0.44 to 33. In 1993 the number increased to 187 and by 1998 it had reached 1422. Traps are useful tools for monitoring low level moth populations and detecting new populations in uninfested areas. They are not used for population reduction. Their use was discontinued after the summer of 1998, as the number of moths trapped became uniformly high and less useful for monitoring.

In 1990, CVNRA sponsored a workshop to discuss the expected gypsy moth problem. Participants included NPS staff from other parks already impacted by the moths, other agency representatives and community representatives. At that time, park managers determined that the park would not pursue active gypsy moth management. There were hopes that the fungus *Entomophaga maimaiga* (Em), which infects and kills gypsy moth larva, might control the moth population as has apparently occurred in the eastern US in recent years. The fungus is known to be present in and around CVNRA. Unfortunately,

these natural controls have not suppressed gypsy moth populations; defoliation has occurred.

Since 1996, the USDA Forest Service has conducted aerial surveys of the park to quantify gypsy moth defoliation. Within the boundaries of the park, moderate to heavy defoliation was detected that covered approximately 39 acres in 1996, 54 acres in 1997, 175 acres in 1998 and 4372 acres in 1999. The portion of defoliation that occurred on land under federal jurisdiction totaled 168 acres in 1998 and 2153 acres in 1999.

In response to the serious defoliation that occurred in 1999, 575 egg mass survey plots were conducted in Fall 1999 to assess the current status of gypsy moth populations in all susceptible forests on federal land within the park (11,329 acres). The assessment and management of non-federal forests is the responsibility of the Ohio Department of Agriculture (ODA).

Results of this survey indicate that some risk of defoliation exists for almost all susceptible forests (USDI-NPS, 2000). A summary of these results can be found in Appendix 1. Egg mass density ranged from 0 to 12,894 per acre across 47 survey blocks (USDI-NPS, 2000). Most areas (10,992 acres) exceed the egg mass density threshold associated with defoliation commonly used for residential nuisance control (250 egg masses/acre). Approximately 10,420 acres exceed 1000 egg masses/acre. Defoliation levels of 40% are predicted at this level of infestation if suppression is not implemented. Predicted defoliation increases rapidly as egg mass densities increase above 1000/acre, with levels approaching 100% defoliation at egg mass densities of 3000/acre (Liebhold *et. al* 1993). Approximately 6560 acres exceed this threshold. The Fall 1999 egg mass surveys indicate that much of the park is at risk for severe defoliation impacts in Spring 2000.

While egg mass density is a primary indicator of expected defoliation levels, other factors such as past defoliation history and egg mass size can be used to predict potential tree mortality, a serious long-term consequence of defoliation. Using a model developed with the USDA Forest Service, these levels of tree mortality risk are predicted across the park:

Tree Mortality Risk	Approx. Acres
High (>25% tree mortality)	2000
Moderate (10-25%)	8100
Low (<10%)	1460

Much of the park will likely experience moderate to high tree mortality from the added stress of another year of defoliation in light of recent drought conditions (USDI-NPS, 2000). While high defoliation risk covers large areas of the park, expected mortality risks are considered highest primarily in areas that may suffer repeated defoliation events. The Forest Service does not expect natural controls to be effective in preventing defoliation in 2000 given the current density and general health of the gypsy moth population, recent drought conditions, and previous years of defoliation.

2. PUBLIC INVOLVEMENT / SCOPING

In reviewing the current gypsy moth issue at CVNRA, park managers have interacted with other state and federal agencies including the USFS, ODA, other land management agencies, local communities and local residents. The park also participated in a Gypsy Moth Task Force formed in the summer of 1999 made up of representatives of many of these groups. A summary of scoping activities and meetings are provided in Appendix 2.

The principal issues of concern for the public identified in our public scoping activities and the FEIS include:

1. How the presence of gypsy moth affects people and the environment;
2. What gypsy moth management options are available; and
3. How gypsy moth management options affect people and the environment.

These and other issues are specifically addressed in this environmental analysis.

3. ALTERNATIVES CONSIDERED

3.1. Process Used To Formulate Alternatives

3.1.1. Management Options

The NPS manages pest species using an Integrated Pest Management (IMP) approach. IPM reduces the negative effects of pests while minimizing the impacts of pest management strategies on people and the environment. The FEIS specifies management options available to agencies interested in managing the gypsy moth under several situations, including monitoring and detection, eradication, 'slow the spread' and suppression, depending upon the occurrence and stage of gypsy moth infestation. The eastern portion of the state of Ohio is within the established zone for gypsy moth suppression. Eradication is aimed primarily at new, isolated infestations and 'slow the spread' is aimed at reducing the expansion of the gypsy moth from infested to non-infested areas. Treatments prescribed for suppression include the use of two biological insecticides, *Bacillus thuringiensis* variety *kurstaki* (*B.t.k.*) and the gypsy moth nucleopolyhedrosis virus (Gypchek®), and one synthetic chemical insecticide, diflubenzuron (Dimilin®).

Gypchek® is the only available insecticide that is target specific to the gypsy moth. When gypsy moth larvae ingest the product containing the virus, it invades the gut wall and attacks the tissues, causing death. Gypchek® has been used extensively and has not been found to affect any other species except for the gypsy moth, in both laboratory and field tests. If adequate supplies were available, this would be the best insecticide to use to avoid non-target impacts. Gypchek® is not known to have adverse human health risks.

B.t.k. is less specific and will affect other lepidopteran (butterflies and moths) larvae that are feeding during the treatment period. It is not known to have direct significant effects on any other orders of animals or plants. This bacteria contains a crystalline structure that

when eaten acts as a stomach poison to the larvae of many species of butterfly or moth that feed on treated leaf tissue and get a lethal dose. While its non-target effects are potentially substantial, the pesticide remains active for only about one week after application. Only lepidopterans that are feeding during this active period may suffer mortality. The impact is also lessened somewhat when applied in a patchwork fashion to highly infested areas. This allows non-target lepidopterans in adjacent non-treated forests to migrate into treated areas throughout the remainder of the season. However, studies on its possible effects continue. After many years of research and use, there is no evidence that the application of *B.t.k* causes adverse effects on people in treated areas.

Diffubenzuron is the least specific and potentially most detrimental pesticide of the three recommended by the Forest Service. It is not being considered for use in CVNRA for reasons outlined in Section 3.2.1.

Gypchek® is preferred over *B.t.k.* as a treatment option primarily due to its host specificity. However, Gypchek® is available only in limited amounts because of a specialized development process that uses live gypsy moth larvae. These supplies are developed and distributed by the Forest Service, and no commercial source is yet available. The Forest Service has set a clear priority for the use of Gypchek® in the protection of federally endangered and threatened species and other sensitive areas. No federally listed species are known to inhabit the park. At this writing, only enough Gypchek® to treat approximately 800 acres is likely to be made available to the park.

The second treatment choice, *B.t.k.*, would be used on any remaining area. The impacts of the action alternatives will be assessed for both Gypchek® and *B.t.k.* in this document. Due to the fact that the gypsy moth population is very healthy throughout much of the area as indicated by egg mass sizes and numbers, the Forest Service has determined that two pesticide applications are needed to ensure successful suppression (USDA, Forest Service 1999).

3.1.2. Management Areas

The decision to implement suppression actions for the gypsy moth is based on egg mass survey data conducted in all susceptible forests on federal land during the autumn of 1999. Egg mass densities, egg mass sizes, and past defoliation history were used to predict defoliation tree mortality risks. All areas with egg mass densities higher than 250 egg masses/acre were recommended for suppression.

Defoliation and tree mortality risk were important considerations when developing alternatives for treatment areas. Defoliation risk is high across much of the park, while tree mortality risk is high primarily in areas (~2000 acres) that suffered previous defoliation. Increased tree mortality is considered the most critical impact of the gypsy moth, as this impact has long-term consequences: loss of habitat, undesirable ecological changes, adverse scenic impacts and hazardous trees. These criteria address the objectives for protection of the forest ecosystem and scenic values.

Another evaluation criterion was recreational use significance as determined by the presence of developed trail systems and recreational facilities. The trail systems and

facilities considered critical for this assessment included the Towpath Trail, the Virginia Kendall Ledges/Octagon area, Happy Days Visitor Center, Boston Run Trail, Salt Run Trail, the Oak Hill Day-Use Area, Carriage Trail, the Cuyahoga Valley Environmental Education Center (CVEEC), Stanford Youth Hostel and the Hale Farm Connector Trail. This criterion addresses the objectives of protecting the recreational and scenic values of the park and the health and safety of visitors and employees.

Proximity of NPS property to private land designated for treatment by the State of Ohio was also considered. An approximate buffer area of 200 feet (the effective width of a single aerial spray path) from adjacent non-NPS land onto NPS land was deemed to be adequate to ensure that non-NPS lands that are treated are ensured of adequate protection from re-invasion by gypsy moths. In a few instances, some additional buffer area was added to ensure that private landowners requesting treatment could meet the State's minimum treatment block size of 50 acres. This criterion addresses the objective of cooperating with other agencies and landowners to suppress the gypsy moth.

Gypchek® should be all areas if available as the potential effects of *B.t.k.* on native Lepidoptera are undesirable. As the park has only a limited amount of Gypchek® available, areas were prioritized for its use. Areas selected for treatment that possessed one or more of these characteristics were considered: butterfly monitoring projects, habitat diversity thought to harbor a diverse lepidopteran fauna (i.e., a mixture of open areas, woodland, and wetlands), state listed plants with lepidopteran pollinators, known nesting sites of state listed bird species, and areas important for environmental education, visitor use, and research. Portions of the Virginia Kendall area, the CVEEC, the Oak Hill Day Use Area, and the Hale Farm Connector Trail area were selected based on these considerations. The Virginia Kendall unit was selected because of habitat diversity, rare plants with lepidopteran pollinators, a nesting site of the state endangered Hermit Thrush, and significant educational value due to the presence of the Happy Days Visitor Center. This area also contains the campus of the Woodlake Environmental Field Station, a significant research and education area. Using Gypchek® at the CVEEC campus provides a good educational example of using the best and most benign techniques available for the control of exotic species. Other areas around the CVEEC, Oak Hill, and Hale Farm were selected because of similar habitat diversity, educational value, and rare plant occurrences.

Treatment areas based upon the above criteria have been somewhat consolidated and generalized to form uniform spray blocks, eliminating small gaps in coverage. This was necessary primarily because of the fragmented pattern of previous defoliation and the patchwork of ownership within and around the park often created a mosaic of very small treated and untreated areas. For example, forested areas with numerous small patches of previous defoliation (i.e., high mortality risk areas) were consolidated into one larger contiguous block to ensure protection across the entire area. Egg mass survey results and the associated defoliation risks were considered when finalizing treatment area boundaries.

3.2. Alternatives Eliminated From Detailed Study

3.2.1. Use of Diflubenzuron (Dimilin®)

Diflubenzuron, a chitin inhibitor, affects all arthropods including aquatic species. It is the least species-specific pesticide of the three recommended by the Forest Service for suppression and is therefore most likely to have the greatest effects on non-target species. It is an insect growth regulator that kills by interfering with the normal development process (molting) of insects and some other related organisms (e.g., crustaceans). It can persist for a long period of time on leaf surfaces, beyond the time of gypsy moth activity. In the autumn, falling leaves can subsequently affect arthropod leaf litter communities, streams and wetlands. No human health risks are likely from exposure as used in gypsy moth projects. However at very high exposures, some very rare potential human health risks could include changes in blood hemoglobin and carcinogenic effects. For these reasons, diflubenzuron was not considered for use in this park.

3.2.2. Other Gypsy Moth Management Strategies

Management strategies considered inappropriate or ineffective for gypsy moth suppression in the FEIS were not considered for use. These include introducing natural controls (e.g., fungal pathogens, parasitoids, and predators), removing and destroying egg masses, tree trunk bands, silvicultural techniques (selective removal of susceptible trees) and using insecticides other than Gypchek®, diflubenzuron, and *B.t.k.* Other strategies such as mass trapping, mating disruption, and sterile insect techniques were also not considered because these methods are effective only at very low egg mass densities (<10 egg masses/acre) and are recommended only for 'slow the spread' situations.

3.2.3. Suppression in Forests With High Mortality Risks Only

The option of spraying only forests facing a high risk of mortality due to another year of defoliation would help to address the project objectives of protecting scenic values and the forest ecosystem. However, this option alone would not address the project objectives of protecting recreational values, providing for visitor safety across the park, and cooperating with other landowners and agencies to suppress the gypsy moth. This option will be considered together with others that address all project objectives.

3.2.4. Suppression in Buffer Zones Only

The option of spraying only buffer areas to non-federal land would address the project objective of cooperating with other landowners and agencies to suppress the effects of the gypsy moth. However, this option alone would not address the project objectives of protecting recreational, scenic and ecological values and providing for visitor safety across the park. This option will be considered together with others that address all project objectives.

3.2.5. Suppression in Recreational Zones Only

The option of spraying only significant recreational areas would address the project objective of protecting many of the recreational and scenic values and visitor safety concerns. However, this option alone would not address the project objectives of protecting ecological values and cooperating with other landowners and agencies to

suppress the effects of the gypsy moth. This option will be considered together with others that address all project objectives.

3.2.6. Other Management Area Combinations

Management area alternatives such as ‘all areas susceptible to gypsy moth’, ‘all areas at risk for defoliation in 2000’, or ‘all areas with moderate to high tree mortality risks’ were not considered separately as they all are likely to require the treatment of most (>95%) of the forested federal land once actual treatment blocks are developed. Since there were only minor differences between these approaches, we selected one for analysis. Alternative 3 examines the option of spraying all areas at risk for defoliation in 2000.

3.3. Alternatives

3.3.1. Alternative 1: No Action

The no action alternative in this document means that CVNRA would take no action to suppress or control the gypsy moth on federal land within the park. The gypsy moth populations and any associated impacts would continue to fluctuate in response to food availability, weather, natural control agents, and suppression activities performed by other agencies and private landowners on adjacent lands.

3.3.2. Alternative 2: Suppression in Critical Areas

This is the preferred alternative. Forested areas that are at high risk for tree mortality due to past defoliation events, areas of significant recreational value, and a 200-foot buffer zone adjacent to non-federal treatment areas would be treated. Approximately 6250 acres of forested federal land would be designated for treatment including 2000 acres with high tree mortality risks, 1900 acres of recreational use zones, 1100 acres of buffer zones, and 1250 acres that help consolidate areas into uniform spray blocks. A map of the treatment area is found in Appendix 3.

A treatment area of approximately 5450 acres would be sprayed with two applications of *B.t.k.* (application rate: 36 BIUs/acre) and approximately 800 acres would be sprayed with two applications of Gypchek ® (application rate: 2×10^{11} occlusion bodies/acre). Low-flying aircraft (fixed wing or helicopters) would apply these pesticides to tree canopies during two separate flights during the 2nd and 3rd larval instars. Larval monitoring will be conducted by the ODA, USFS and NPS. The first application would be just after the emergence of the gypsy moth caterpillar in early May. The second application would follow 5 to 7 days later and would be an attempt to increase the effectiveness of the suppression program by exposing gypsy moth caterpillars that may have survived/escaped the first application.

3.3.3. Alternative 3: Suppression in All Areas at Risk for Defoliation

All forests that are at risk for gypsy moth defoliation in 2000 would be treated. Approximately 11000 acres of forested federal land would be designated for treatment. Treatment areas would be sprayed as described in Alternative 2, with the additional 4750 acres treated with *B.t.k.* A map of the treatment area is found in Appendix 4.

4. IMPACTS OF THE ALTERNATIVES

4.1. Methodology

A number of ecological, cultural, social, and economic factors were considered in assessing the potential environmental impacts of the alternatives being considered. A large amount of information on impacts were compiled and analyzed in respect to gypsy moth treatment alternatives in the FEIS. This information was supplemented with additional scientific literature and consultation with other agencies and scientists. The analysis of impacts in this section is tiered off of the FEIS and is appropriately brief and focused on critical site-specific issues. Additional detail on the effects of Alternatives the environment is available in the FEIS.

4.2. Summary of Environmental Impacts of Alternatives

The results of these evaluations are summarized in Table 1 below. If no impact is expected, this is indicated with an 'N' (No). If an impact is anticipated for a factor, this is indicated with a "Y" (Yes). If a beneficial or positive impact is expected, this is indicated with a plus sign (+). If a negative impact is expected, this is indicated with a minus sign (-). Note that an alternative may have both positive and negative impacts. Environmental factors that are likely to be affected by one or more of the alternatives are reviewed in the next section.

Table 1. Summary of Environmental Impacts of Alternatives

ENVIRONMENTAL CONSIDERATIONS	ALTERNATIVES		
	1	2	3
<u>Biological Environment</u>			
Gypsy moth	Y±	Y±	Y±
Non-target Lepidoptera (butterflies and moths)	Y±	Y±	Y±
Other wildlife	Y±	Y±	Y±
Vegetation	Y±	Y±	Y±
Federally listed endangered or threatened species	N	N	N
State listed endangered or threatened species	Y±	Y±	Y±
Critical habitats (for federally listed species)	N	N	N
<u>Physical Environment</u>			
Cultural landscape	Y-	Y-	N
Properties listed on the National Register of Historic Places	Y-	Y-	N
Properties eligible for listing on the National Register of Historic Places	Y-	Y-	N
Property listed on the National Registry of Natural Landmarks	N	N	N
Property listed as a National Historic Landmark	N	N	N
Property listed on the World Heritage list	N	N	N
Known archaeological sites	Y-	Y-	N
Conversion of prime farmland	N	N	N
Scenic values	Y-	Y+	Y+

ENVIRONMENTAL CONSIDERATIONS**ALTERNATIVES****1 2 3****Physical Environment (continued)**

Private Land	Y-	Y+	Y+
Coastal zone	N	N	N
Floodplains	N	N	N
Wetlands	Y-	Y-	N
Air Quality	N	N	N
Water Quality	Y-	Y-	N

Social Environment

Visitor use patterns	Y-	Y±	Y±
Visitor travel patterns	Y-	Y±	Y±
Travel patterns of transients (i.e., passers-by, commuters)	N	N	N
Recreational opportunities	Y-	Y±	Y±
Local communities	Y-	Y±	Y±
Visitor and employee safety	Y-	Y+	Y+
Safety of transients	Y-	Y-	N
Visitor and employee health	Y-	Y±	Y±
Health of transients	Y-	Y-	N

Economic Factors

Regional employment trends	N	N	N
Local employment trends	Y+	N	N
Visitor expenditures	Y-	Y±	Y±
Local economies	Y-	Y±	Y±

4.3. Impacts of the Alternatives

4.3.1. Impacts of Alternatives on the Biological Environment

4.3.1.1. Gypsy Moth

Affected Environment

The current status of the gypsy moth population is discussed in Section 1.7. The gypsy moth is the target for the proposed action.

Direct and Indirect Effects

Alternative 1 would allow gypsy moth populations to fluctuate unimpeded in response to environmental conditions, host availability, predation, and natural control organisms. Fluctuations may include future outbreaks or population crashes. Fall 1999 egg mass surveys indicate that defoliation is likely to occur throughout much of the park in 2000. Left unchecked, the gypsy moth population is expected to continue to cause significant amounts of defoliation in some areas of the park for several more years before a population crash. In Alternative 2, significant mortality (60-90%) to young gypsy moth caterpillars is expected in treated areas. A reduction in gypsy moth populations is expected for 1-2 years following treatment, although some small areas of high population density may remain. Caterpillars outside treated areas would be expected to fluctuate as in Alternative 1. The impacts of Alternative 3 are the same as Alternative 2, but would affect caterpillars throughout a larger area.

Cumulative Impacts

In Alternative 1, the reduced availability of preferred host tree species may occur if outbreaks cause significant tree mortality. This may cause gypsy moth population declines. In Alternative 2, the future effectiveness of natural control by the fungus *Entomophaga maimaiga* (Em) and the nucleopolyhedrosis virus (NPV) may be diminished in treatment areas because these natural controls are most effective at high population densities. This may benefit gypsy moth populations. However, as expected mortality levels will not be 100% and many pockets of gypsy moth populations will remain untreated, these natural controls are expected to remain in place throughout the ecosystem. The cumulative impacts of Alternative 3 are the same as Alternative 2, but would affect a larger area. The effectiveness and presence of natural controls could be reduced even more than in Alternative 2 since fewer pockets of gypsy moth populations would remain untreated.

4.3.1.2. Non-target Lepidoptera (Butterflies and Moths)

Affected Environment

Some limited information on the lepidopteran fauna of CVNRA is available. Records for the two counties that encompass CVNRA indicate that at least 86 species of butterflies and skippers are known from Cuyahoga County and 65 species are known Summit County (Iftner *et al.* 1992). Butterfly monitoring projects have generated information on the Lepidoptera species found in CVNRA from two small areas of the park (USDI, National Park Service 1999b). Fifty-nine butterfly species have been documented thus far but there are probably many more species of butterflies, skippers, moths and microlepidoptera that remain undocumented.

A current list of butterfly and skipper species and their habitats is found in Appendix 5. More than 20 of these species are closely associated with forest habitats and margins and some are specifically associated with oak dominated areas including the Banded Hairstreak (*Satyrrium calanus falacer*), Edwards' Hairstreak (*Satyrrium edwardsii*), Juvenal's Duskywing (*Erynnis juvenalis*), Horace's Duskywing (*Erynnis horatius*), Sleepy Duskywing (*Erynnis brizo*), and the Northern Cloudywing (*Thorybes pylades*).

Direct and Indirect Effects

The impact of the gypsy moth and gypsy moth treatments on native Lepidoptera will largely be dependent upon the species and developmental stages of caterpillars in the treatment areas. Characteristics such as larval stages and activity, number of broods per year, host plant preferences, habitat associations and other factors may determine susceptibility. It is expected that spring-feeding lepidopterans and species more closely associated with forested areas are most likely to be directly affected, but other species may also be affected indirectly. For example, changes in the understory may subsequently affect host plant availability.

In Alternative 1, native Lepidoptera dependent upon forests and forest margin habitats, especially oak-dominant forests, may be negatively affected by an additional defoliation event and the resulting tree mortality. Other species may benefit by the presence of gypsy moths and their effects on the habitat due to changes in understory host plant communities. In Alternative 2, some non-target Lepidoptera populations that are actively feeding during and 8-10 days after treatment are expected to suffer mortality in areas treated with B.t.k., resulting in temporary population declines. The level of mortality experienced will vary from species to species. No such treatment effects are expected in areas treated with Gypchek®. The impacts of Alternative 3 are the same as Alternative 2, but would affect Lepidoptera throughout a larger area.

Cumulative Impacts

In Alternative 1, forest-dependent Lepidoptera may be negatively affected by future defoliation events and the resulting tree mortality and changes in forest composition. Lepidoptera associated with open woods not dominated by oaks may benefit from these impacts. Other species may benefit from changes in the understory brought about by defoliation and tree mortality. Under Alternative 2 and 3, native Lepidoptera populations may remain low for several years but are expected to recover to pre-treatment levels within 1-2 years of treatment through recolonization and reproduction. Recovery time for each species may be dependent upon the number of broods per year (i.e., species with multiple broods may recover more quickly) and dispersal abilities. Recovery may be slower under Alternative 3 as it covers a larger area and reduces the opportunity for dispersal from untreated adjacent areas.

4.3.1.3. Vegetation

Affected Environment

CVNRA contains more than 19,000 acres of forest, most of which is susceptible to gypsy moth defoliation, including oak-hickory, maple-oak, oak-beech-maple, hemlock-beech, pine-spruce, and maple-sycamore forest types. Oak-type forests, the most highly preferred host type for gypsy moths comprise approximately 80% of forest cover. Approximately 12,000 acres of forests susceptible to gypsy moths are under federal jurisdiction. Important riparian zones exist along the river and streams. Other major park habitats include old field/scrub, agricultural fields, wetlands, and suburban lands. Approximately 900 plant species occur in the park.

Direct and Indirect Effects

In Alternative 1, defoliation is expected to occur throughout much of the park, especially in oak-dominated areas. Deterioration of tree health is expected in defoliated areas, which leads to increased tree mortality. Some trees may die after one year of defoliation stress, but tree mortality is expected to be higher in areas suffering from repeated defoliation events. Defoliation allows sunlight to penetrate to the forest floor, benefiting some shade-intolerant species while adversely affecting other plants that require shade. Changes in humidity levels on the forest floor may affect plant growth. Changes in the forest understory composition would be expected.

In Alternative 2, treatment areas would largely be protected from gypsy moth defoliation and its impacts. A temporary reduction in lepidopteran pollinators in areas treated with B.t.k may occur. Impacts similar to Alternative 1 are expected in untreated areas. In Alternative 3, effects similar to Alternative 2 are expected except over a larger area.

Cumulative Impacts

In Alternative 1, repeated outbreaks of gypsy moth may lead to the loss of oak species and other trees and could permanently change the composition of the forest and its understory vegetation. Loss of oaks may make the forests less susceptible to gypsy moth in the future. Species adapted to openings in the forest are expected to thrive while shade-tolerant species may decrease in abundance. Both Alternatives 2 and 3 may protect treated areas from the impacts of defoliation for several years. Lepidopteran pollinators are expected to recover to pre-treatment levels within 1-2 years.

4.3.1.4. Wildlife

Affected Environment

The forests, fields, wetlands, streams, and ponds in CVNRA harbor a broad diversity of wildlife, including 32 species of mammals, approximately 200 species of birds, 22 amphibians, 18 reptiles, and 28 fish species. Some notable species include coyote (*Canis latrans*), white-tailed deer (*Odocoileus virginianus*), beaver (*Castor canadensis*), and great-blue herons (*Ardea herodias*). Other than aquatic macroinvertebrate fauna, which number in the hundreds, the invertebrate taxa are not well inventoried. Hundreds of insects, arachnids, crustaceans and other invertebrate species are probably found in CVNRA.

Direct and Indirect Effects

In Alternative 1, the expected gypsy moth defoliation may affect the abundance and distribution of wildlife due to changes in vegetation and habitat structure. Some species may respond favorably while others are negatively impacted. For example, defoliation causes a loss of cover for nesting bird species, increasing predation risk. A reduction in the abundance of other leaf-feeding insects can be expected as well, reducing food availability for some songbirds. However, some wildlife species may thrive in response to the abundant gypsy moth caterpillar as a food source itself (e.g., cuckoos). White-tailed deer may migrate to avoid defoliated areas. Decreased acorn production in oaks stressed by defoliation can reduce food availability and may cause declines in some acorn-dependent wildlife populations. Defoliation can increase water temperatures in small streams and can cause declines in fish and aquatic invertebrate populations.

In Alternatives 2 and 3, the impacts to wildlife resulting from defoliation would largely be prevented in treated areas. *B.t.k.* is not known to have significant direct effects on any other wildlife, except feeding Lepidoptera as discussed in Section 4.3.1.2. Gypchek affects only the gypsy moth. Birds and mammals may temporarily switch their diet due to a reduction of caterpillars in treated areas. It is possible that some gypsy moth parasitoids (e.g., parasitic wasps) may be negatively or positively indirectly affected by a reduction in their host.

Cumulative Impacts

In Alternative 1, tree mortality due to defoliation stress may cause reductions or elimination of squirrel and tree nesting bird populations but may also provide additional habitat (in the form of dead trees) for other wildlife. Acorn production may be reduced for several years after the actual defoliation events. Increased understory growth due to forest openings may provide additional habitat and food sources for some wildlife. Both Alternatives 2 and 3 may protect treated areas from the impacts of defoliation on wildlife for several years. Lepidopteran caterpillars are expected to recover to pre-treatment levels within 1-2 years.

4.3.1.5. Endangered and threatened species

Affected Environment

No federally listed endangered or threatened species are known to occur in CVNRA. The federally threatened bald eagle (*Haliaeetus leucocephalus*) has been reported to occasionally move through the park, but is not known to nest in the area. CVNRA has habitat suitable for the federally endangered Indiana bat (*Myotis sodalis*), but there are no verifiable records for the species in the park. The US Fish and Wildlife Service has been consulted in accordance with the Endangered Species Act and has determined that the action alternatives would have no effect on these species (Appendix 6). Some state-listed endangered, threatened or potentially threatened bird and plant species have been recorded in CVNRA including 20 birds and 22 plants.

Most of the state-listed birds recorded in the park are known only as transient migrants or accidental occurrences. Only 3 species are recorded as having nested in the park including the Dark-eyed Junco (*Junco hyemalis*), Winter Wren (*Troglodytes troglodytes*), and Hermit Thrush (*Catharus guttatus*). At least ten of the state listed bird species are more closely associated with forested habitats, including:

<u>Common Name</u>	<u>Scientific Name</u>
Canada Warbler	<i>Wilsonia canadensis</i>
Dark-eyed Junco	<i>Junco hyemalis</i>
Golden-winged Warbler	<i>Vermivora chrysoptera</i>
Hermit Thrush	<i>Catharus guttatus</i>
Loggerhead Shrike	<i>Lanius ludovicianus</i>
Magnolia Warbler	<i>Dendroica magnolia</i>
Northern Waterthrush	<i>Seiurus noveboracensis</i>
Sedge Wren	<i>Cistothorus platensis</i>
Winter Wren	<i>Troglodytes troglodytes</i>
Yellow-bellied Sapsucker	<i>Sphyrapicus varius</i>

Twenty-two state listed endangered, threatened or potentially threatened plants have been recorded in the park. Of these species, twelve are found at least occasionally in and near forested habitats, including: *Carex actata*, *Carex argyrantha*, *Carex radiata*,

Corallorrhiza maculata, *Corydalis sempervirens*, *Cypripedium calceolus* var. *pubesens*, *Lechea intermedia*, *Platanthera orbiculata*, *Poa languida*, *Solidago squarrosa* and *Spenopholis pensylvanica*. Only a few of the state listed plants are thought to be pollinated by Lepidoptera. *P. orbiculata* is definitely pollinated by hawk moths and noctuid moths, and two other species, *L. intermedia* and *Sheperdia canadensis*, are possibly pollinated by small lepidopterans along with other insects (W. Stoutamire, pers. comm. 2000).

Direct and Indirect Effects

Alternative 1 may affect state-listed bird species as described for birds in Section 4.3.1.4. Those more closely associated with forested habitats and adjacent open areas and that nest in the park are probably more sensitive to these changes. Species associated with closed canopy forests may be negatively affected, while others may thrive in response to changes and openings in the forest caused by gypsy moth outbreaks. Alternative 2 would largely protect state-listed species from the consequences of defoliation in treated areas. This alternative may cause some of the state-listed birds, especially nesting species to temporarily switch diets in response to a reduced abundance of caterpillars, but adjacent untreated areas would remain unaffected. This impact is reduced in areas treated with Gypchek®. The only recorded nesting occurrence of the Hermit Thrush occurs within areas to be treated with Gypchek®. Alternative 3 would have similar effects to Alternative 2, except that caterpillar abundance would be reduced across a larger area of the park.

In Alternative 1, state-listed rare plants that are dependent upon closed-canopy forests may be negatively affected by additional defoliation events. For example, *P. orbiculata* prefers shaded habitats and may not respond favorably to defoliation. However, other species may benefit from the additional sunlight that reaches the forest floor. In Alternative 2, state-listed rare plants in forests would largely be protected from the impacts of defoliation in treated areas. A temporary reduction in lepidopteran pollinators may affect the reproduction of a few state-listed species in areas treated with *B.t.k.* This impact may be small, as rare plants may not normally reproduce each year and are often adapted to delayed reproduction. Furthermore, this impact is not expected in areas treated with Gypchek®. Six of the eight known occurrences of the three state-listed plants that may be pollinated by Lepidoptera are in areas designated for Gypchek® treatment. Alternative 3 would have the same impacts as Alternative 2, except across a larger area.

Cumulative Impacts

In Alternative 1, changes in the forest canopy and understory due to repeated defoliation events may change the distribution and abundance of state-listed plants and animals. In Alternative 2 and 3, these species may be protected from these impacts in treated areas for several years. Lepidopteran caterpillars are expected to recover to pre-treatment levels within 1-2 years.

4.3.2. Impacts of Alternatives on the Physical Environment

4.3.2.1. Historical, Cultural and Archaeological Resources

Affected Environment

CVNRA contains many historical sites and structures that may be associated with landscaping or historically significant plantings that could be susceptible to gypsy moth defoliation. Sixty-four such sites are currently listed on the National Register of Historic Places and carry additional responsibility to preserve the cultural landscape. The most significant in size is the 530 acre Virginia Kendall Historic District is listed as historically significant due to its portrayal of "naturalistic landscape design" in which a pattern of open and wooded spaces was utilized, including historical plantings by the Civilian Conservation Corps in the 1930s. Additionally, more than 200 archaeological sites have been documented in the park. Cultural and archaeological resource compliance for this project as required under federal law has been initiated.

Direct and Indirect Effects

Under Alternative 1, susceptible historical plantings and landscaping trees may be defoliated, increasing the risk of tree mortality. Trees near archaeological resources may be impacted similarly, leading to changes in the environment (e.g., increased erosion potential and sunlight) around these areas leading to possible impacts. The gypsy moth and their droppings may cause some discoloration of historical buildings, especially in highly infested areas. In Alternative 2, cultural resources in areas designated for treatment would largely be protected from the effects of gypsy moths. The cultural landscape in the Virginia Kendall unit is included in the treatment area, addressing the most significant cultural resource concern. Effects similar to Alternative 1 would be expected in untreated areas, possibly leaving some cultural resources unprotected. Alternative 3 would have the same effect as Alternative 2, but would also protect additional areas.

Cumulative Impacts

For Alternative 1, the loss of historical plantings and landscaping may require the replacement of individual trees, perhaps with different species not as susceptible to gypsy moths. This could lead to undesirable changes in the cultural landscape over time and the unnecessary loss of cultural resources. Some buildings may require cleaning or repainting if repeatedly stained by gypsy moths and their droppings. Areas designated for treatment in Alternatives 2 and 3 may be protected from these effects for several years.

4.3.2.2. Scenic Values

Affected Environment

CVNRA is composed of a largely forested landscape bisected by the Cuyahoga River, interspersed with old fields, agriculture, and historic buildings. Visitors and passers-by

can enjoy this landscape from the many roads and highways and more than 100 miles of trails that cross the park. The scenic values of the park are increasing as natural areas outside the park face increasing development pressures.

Direct and Indirect Effects

In Alternative 1, gypsy moths will negatively affect the scenic values of the park if defoliation occurs as expected. Large expanses of defoliated forest are unattractive and appear unnatural, as trees should be in full foliage during this time of year. It is possible that other aesthetically pleasing species such as wildflowers may increase in number due to defoliation and thereby enhance scenic value. In Alternative 2, no impacts to scenic values due to gypsy moth defoliation are expected in treated areas as noticeable defoliation are expected to be largely prevented. Defoliation that may occur in untreated areas may affect scenic values in those areas. Alternative 3 provides the most protection for scenic values because the larger treatment area includes all areas susceptible to defoliation.

Cumulative Impacts

In Alternative 1, gypsy moths may negatively affect the scenic values of the park through repeated outbreaks. Increased tree mortality in areas experiencing multiple defoliation events will leave a large number of dead trees in some areas, negatively affecting the aesthetics of the forest for a longer period of time. Both Alternatives 2 and 3 may protect treated areas from the impacts of defoliation on scenic values for several years.

4.3.2.3. Private Land

Affected Environment

A patchwork of ownership exists within the park boundary. Only approximately 18,000 of the 33,000 acres within the CVNRA boundary are owned by the federal government. Other lands are owned and managed by metropark systems, scout camps, golf courses, ski areas, and individuals. Outside its boundary, the park is largely surrounded by private land. In response to the 1999 gypsy moth outbreak, many private landowners and communities organized to apply in blocks for survey and treatment by the State of Ohio. Most of these areas satisfy the State's spray program criteria and will be treated.

Direct and Indirect Effects

In Alternative 1, the expected gypsy moths outbreak on federal land may affect neighboring non-federal land, including land that is actually being treated for gypsy moths this year. Mature gypsy moth caterpillars may migrate several hundred feet from where they have depleted their food source into adjacent untreated areas, possibly leading to defoliation and tree mortality despite the suppression activities of the landowner. In Alternative 2, nonfederal land that is designated for treatment would largely be protected from gypsy moth caterpillars dispersing from adjacent federal land as adequate buffer

zones to all non-federal lands undergoing treatment would also receive treatment. Alternative 3 would have the same effect as Alternative 2, but would also protect some additional non-federal land not designated for treatment this season from the dispersal of gypsy moths.

Cumulative Impacts

In Alternative 1, gypsy moths may become reestablished on non-federal land despite being treated this season because of movement from untreated federal land. This may result in the need to treat these areas again next year. Alternative 2 may protect non-federal land from dispersing gypsy moth populations for several years. Alternative 3 would have the same effect as Alternative 2, but would also protect some additional non-federal land.

4.3.2.4. Water Quality and Wetlands

Affected Environment

More than 20 miles of the Cuyahoga River passes through CVNRA. Numerous streams and tributaries totaling 190 miles exist within the park boundary. More than 70 man-made ponds and lakes dot the landscape. The park staff and other agencies closely monitor water quality. Water quality varies from good to poor across the park, with major concerns for septic and treatment plant discharge and erosion. Wetlands are found throughout the park and represent an important habitat for many animal and plant species.

Direct and Indirect Effects

In Alternative 1, gypsy moths may affect the water quality of the park rivers and streams if defoliation occurs as expected. The results of defoliation can include temporary changes in water temperature, dissolved oxygen levels, pH, nutrient concentration, sediment load, stream discharge and flow rate, and other variables. Affected streams may pass these impacts to the wetlands in which they may drain. In Alternative 2, the impacts of defoliation on water quality and wetlands may be largely prevented in treated areas. No effects on water quality from pesticide treatments are anticipated. Impacts similar to Alternative 1 may be expected in untreated areas. Alternative 3 would have the same effect as Alternative 2, but would protect additional areas.

Cumulative Impacts

In Alternative 1, the loss of trees due to the stresses of defoliation can increase the impacts on water quality and wetlands. In Alternative 2, the impacts of defoliation on water quality may be largely prevented in treated areas for a number of years. Alternative 3 would have the same effect as Alternative 2, but would protect additional areas.

4.3.3. Impacts of Alternatives on the Social Environment

4.3.3.1. Visitor Use and Recreational Value

Affected Environment

CVNRA contains many important recreational facilities, including the Ohio & Erie Canal Towpath Trail, over 100 miles of additional trails, several day use areas, two visitor centers, and an environmental education center. CVNRA receives more than 3.5 million visits annually, with the highest visitation occurring during the spring, summer and fall months.

Direct and Indirect Effects

In Alternative 1, gypsy moths are likely to impact the recreational value of the park if an outbreak occurs as expected. Visitor experiences may be negatively affected by forests denuded of foliage, the lack of shade on trails, large amounts of caterpillars and frass (caterpillar droppings), and health and safety concerns. Some potential visitors may respond by avoiding use of the park during the summer while gypsy moths are active. In Alternative 2, the impacts to recreational values and visitor use due to gypsy moth defoliation would be largely prevented. The most significant park trails and facilities likely to be affected by gypsy moth outbreaks would be treated. Some areas of moderate to low use and undeveloped areas may experience impacts to recreational value if outbreaks occur in those areas. Visitor use may be briefly impacted during the treatment period (~10 days) as visitors may avoid being in the park during the application of pesticides. Visitors may experience reduced opportunities for viewing native Lepidoptera in areas treated with *B.t.k.* Alternative 3 would have the same effects as Alternative 2, but would involve additional areas.

Cumulative Impacts

In Alternative 1, repeated gypsy moth outbreaks and safety concerns regarding dead trees and falling limbs may affect recreational values and visitor use over the long-run as visitors learn to avoid troublesome areas. In Alternative 2, impacts to recreational values and visitor use due to gypsy moth defoliation are expected to be largely prevented for several years in treated areas. Viewing opportunities for native Lepidoptera are expected to return to pre-treatment levels within 1-2 years. Alternative 3 would have the same impacts as Alternative 2, but would involve additional areas.

4.3.3.2. Health and Safety

Affected Environment

In addition to the 3.5 million visitors each year, CVNRA employees number approximately 200. Additionally, approximately 1200 park volunteers assist in a variety

of programs and projects. Many employees and volunteers spend significant amounts of time outdoors. Many additional people just pass through the park each year as transients.

Direct and Indirect Effects

In Alternative 1, gypsy moths may affect the health and safety of visitors, employees and transients. Skin rashes and other irritations from contact with gypsy moths may occur. Some sensitive individuals may become allergic to the gypsy moth. Increased tree mortality resulting from defoliation stresses may pose a hazard due to falling limbs and trees. Some potential visitors may respond by avoiding use of the park areas containing many dead trees. Defoliated areas are also at an increased risk of fire danger due to solar drying of leaf litter. Transients (visitors that just pass through the park) could be affected if dead trees fall in the road causing a hazard. In Alternative 2, the impacts to the health and safety use due to gypsy moth defoliation may be largely prevented. The most significant park trails and facilities likely to be affected by gypsy moth outbreaks would be treated. Some impact to visitor health and safety may occur in untreated areas.

There is no evidence after years of study and use that the application of *B.t.k.* would affect people in treated areas. For *B.t.k.*, minor irritations of the skin, eyes or respiratory tract may occur in people who handle and apply the pesticide. Gypchek has no known adverse effects on people, but some sensitive individuals that are exposed may experience minor irritations similar to that of the gypsy moth. These effects are much more likely to occur in people who handle and apply the pesticide. Alternative 3 would have the same impacts as Alternative 2, but would protect additional areas.

Cumulative Impacts

In Alternative 1, repeated gypsy moth outbreaks and safety concerns regarding dead trees and falling limbs may affect public health and safety over the long run as the number of dead and potentially hazardous trees increase. In Alternative 2, impacts to public health and safety due to gypsy moth defoliation are expected to be largely prevented for several years in treated areas. Alternative 3 would have the same impacts as Alternative 2, but would protect additional areas.

4.3.3.3. Local Communities

Affected Environment

Parts of fifteen townships, villages and cities in two counties are within the park, with the Village of Peninsula being completely surrounded by the park. These neighboring communities include a mix of residential, agricultural and business areas. No minority or economically disadvantaged populations are expected to be inordinately impacted by any of the alternatives.

Direct and Indirect Effects

In Alternative 1, the expected gypsy moth outbreak on federal land may affect neighboring non-federal land, including land that is actually being treated for gypsy moths this year. Mature gypsy moth caterpillars may migrate several hundred feet from where they have depleted their food source into adjacent untreated areas, possibly leading to defoliation and tree mortality despite suppression activities. In Alternative 2, nonfederal land that is designated for treatment would largely be protected from gypsy moth caterpillars dispersing from adjacent federal land as adequate buffer zones to all non-federal lands undergoing treatment would also receive treatment. Alternative 3 would have the same effect as Alternative 2, but would also protect some additional non-federal land not designated for treatment this season from the dispersal of gypsy moths.

Cumulative Impacts

In Alternative 1, gypsy moths may become reestablished on non-federal land despite being treated this season because of movement from untreated federal land. This may result in the need to treat these areas again next year. Alternative 2 may protect non-federal land from dispersing gypsy moth populations for several years. Alternative 3 would have the same effect as Alternative 2, but would also protect some additional non-federal land from dispersing gypsy moths.

4.3.4. Impacts of Alternatives on the Economic Environment

Affected Environment

See Sections 4.3.3.1 and 4.3.3.3 for descriptions of visitors and local communities. It is likely that the numerous small businesses (e.g., bike shops, restaurants) in and around the park benefit from the expenditures of park visitors. Additionally, tree trimming and removal businesses may be directly affected by gypsy moth outbreaks.

Direct and Indirect Effects

In Alternative 1, future gypsy moths outbreaks may cause potential visitors to avoid the park and neighboring communities while gypsy moths are active due to nuisance, health and safety concerns. This reduced visitation could negatively impact local economies and visitor expenditures. Businesses that specialize in tree trimming and removals may benefit from additional work opportunities in and around the park. This could result in temporary increases in employment and profit. In Alternatives 2, these impacts would largely be avoided. Potential visitors may avoid the park and surrounding communities during the treatment period due to concerns over the pesticide use. Work opportunities in tree removal may exist but would be less than in Alternative 1. Alternative 3 has the same impacts as Alternative 2, except that more areas would be protected from gypsy moth impacts.

Cumulative Impacts

No cumulative impacts are expected.

4.4. Recommendation

Data from gypsy moth egg mass surveys in 1999 indicate the need for selected pesticide applications during the spring of 2000. Based upon the analysis documented in this environmental analysis, the FEIS, and the site-specific biological evaluation provided by the Forest Service, it is our recommendation that Alternative 2 be implemented. This will involve treatment of approximately 5450 acres of forested federal land with two applications of *B.t.k* and 800 acres with two applications of Gypchek ® in an Integrated Pest Management approach to suppress damaging levels of the gypsy moth population in CVNRA in 2000.

While positive and negative impacts can be identified for all of the alternatives, Alternative 1 has the greatest potential for both short-term and long-term negative impacts to people and the environment. If pesticides are not applied, severe defoliation to the forested areas of the park is expected, possibly resulting in significant tree mortality especially in areas previously defoliated. Impacts to scenic, recreational and ecological values, and public health and safety are expected. Furthermore, adjacent non-federal lands would not be protected from dispersing gypsy moths, even if those areas are treated. Suppression activities as outlined in Alternative 2 and 3 would help address the impacts expected under Alternative 1. However, Alternative 3, which would require spraying almost all forested areas, may have additional undesirable negative effects on non-target species such as native Lepidoptera and on the natural controls of the gypsy moth.

Alternative 2 best addresses the project objectives of minimizing the short and long-term effects of gypsy moth outbreaks on the scenic, recreation and ecological values of the park while supporting suppression activities on adjacent non-federal land. Critical areas are designated for treatment while other areas remain untreated. This approach will help to mitigate and minimize any impacts that this alternative may have on non-target organisms and the natural controls of the gypsy moth. Any temporary effects that treatment may have are outweighed by the potential long-term impacts of Alternative 1. This alternative is compatible with the selected alternative in the FEIS and ROD, in that these biological insecticide applications are the only operational IPM component that will meet the objectives identified in this EA. The objectives and methodology outlined in this EA and ongoing monitoring data should be used to identify any areas in need of treatment in the future.

In carrying out this action, the NPS is bound by the provisions of the National Environmental Policy Act of 1969 (NEPA) which requires environmental analysis of proposed major federal actions that may significantly effect the quality of the human environment. NEPA and NPS policies require assessment of alternative management actions to facilitate balanced, integrated approaches to resource protection and

development. These requirements have been met by the FEIS and ROD and the development of this site-specific EA. The selected alternative involves the use of insecticides that are registered for suppression of the gypsy moth, and which will be applied according to label requirements. This meets the provisions of the federal Insecticide, Fungicide, and Rodenticide Act of 1947 as amended.

Our recommendation to implement Alternative 2 is based upon compliance with, and the authority granted by the federal laws and regulations previously described and with NPS policies. This project conforms to the USFS policy to protect and preserve the forest resources of the nation against destructive forest insects and disease. This recommendation was guided and is supported by the following factors:

1. The insecticides proposed for use are registered for that intended purpose by the Environmental Protection Agency;
2. Insecticide applications proposed in CVNRA comply with EPA label directions, city and federal laws, and NPS regulations;
3. The insecticides chosen affect only gypsy moths and other Lepidoptera present in treatment areas at the time of spraying;
4. The potential effects of treatment on non-target Lepidoptera populations are considered temporary and partially mitigated by leaving many areas untreated;
5. The USFWS has determined that no federally listed endangered or threatened species would be adversely affected by suppression actions;
6. No significant impacts to state listed endangered or threatened species, or other native flora or fauna are expected from the proposed project;
7. *B.t.k.* and Gypchek ® are extremely safe to use around humans;
8. The public involvement, public notification, project monitoring procedures and mitigation measures that will be followed and implemented during the project will reduce the potential adverse environmental effects on areas treated and will minimize the risk of exposure to individuals visiting and residing in or near areas treated;
9. There are no apparent significant deleterious effects on the environment; and
10. The CVNRA suppression project is within the scope of the FEIS and the decision announced in the ROD.

4.5. Mitigating Measures

The treatment program will be conducted such that every aspect will proceed only if it can be done so safely. Pesticides will be applied in accordance with pesticide label specifications. Every effort will be made to restrict the application of pesticides to target areas and to minimize drift to off-site areas. Spray areas on federal land will be included in a cooperative treatment plan with the ODA.

Pilots will be provided with digital and hardcopy maps of treatment areas. Delineated spray areas will be defined by Global Positioning System (GPS) technology used onboard the aircraft. Pilots will be briefed daily on conditions and on any unusual features that require consideration or special attention. In addition to the application aircraft, a second observation craft with personnel from the USDA Forest Service will follow to monitor and guide spray activities.

A news release will be prepared to notify the public about treatments. Signs will be posted in visitor centers and information sites around the park several weeks prior to any spray. During spray operations, activities at CVNRA will be coordinated with the ODA and included in their public updates. Information will be provided to anyone who requests it in person or by telephone. Maps of the treatment areas and copies of the environmental assessment will be available for inspection at CVNRA Headquarters in Brecksville and the park WWW site (<http://www.nps.gov/cuva>).

Coordination with the CVEEC and CVNRA Interpretation staff will help minimize the effects of treatment on outdoor education programs. Whenever possible, treatments will be scheduled to not conflict with outdoor programs. Additionally, alternative indoor programming will be scheduled whenever possible. Participants in CVNRA and CVEEC educational and recreational programs and those requesting permits for park facilities during the month of May will be informed of possible treatment actions.

4.6. Project Monitoring

As part of an ongoing IPM program, annual monitoring of forests for defoliation, surveys of gypsy moth populations and post-treatment efficacy of treatments will be conducted. The effectiveness of the spray application will be assessed through the placement of spray cards in selected treatment areas. The park will continue to monitor gypsy moth populations throughout 2000 and subsequent years. Aerial surveys later in the summer will document any defoliation that may occur in the park. Egg mass surveys performed as needed during the fall of 2000 should provide insight as to the effectiveness of this spray program when compared to data from earlier egg mass surveys. It is expected that most treated areas will be protected from defoliation for several years.

The management of the gypsy moth is an ongoing process. The decision to treat areas of the park in the future will be based upon the same project objectives and analysis outlined in this EA. Egg mass surveys and aerial observations of defoliation will be used to assess

the need for future treatments across the park. Total treatment area will change from year to year, and it is expected that no treatment will be needed some years. Separate EAs will be developed to address any future suppression activities and will be made available for public review.

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7. REFERENCES

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Appendix 1: Gypsy Moth Egg Mass Survey Results, Cuyahoga Valley NRA, Ohio
November 1999 (USDI, National Park Service, 2000).

Block	Acres	Egg Masses/Acre				Egg Mass Length				Mort.	
		Plots	Mean	SD	SE	n	Mean	SD	SE	Risk	Def. 99
2	59.2	5	4351	8399.4	3756.3	25	31	7.3	1.5	M	
3	218.0	12	1570	2750.5	794.0	34	25	7.0	1.2	M	
4	182.8	10	1068	1653.5	522.9	28	34	4.7	0.9	M	
6	101.3	7	211	256.9	97.1	17	27	9.4	2.3	L	
7	22.8	4	1080	1484.5	742.2	16	32	7.8	2.0	M	
8	293.7	15	5513	4005.4	1034.2	68	24	5.7	0.7	H/M	Y
9	195.6	11	1186	977.3	294.7	50	30	9.0	1.3	H/M	Y
10	754.1	33	8084	14561.6	2534.9	146	21	5.8	0.5	H/M	Y
11	634.9	27	4910	3913.8	753.2	111	24	5.7	0.5	H/M	Y
12	86.9	6	1743	747.7	305.3	30	19	8.4	1.5	M	
13	108.4	6	4703	4639.1	1893.9	28	26	7.8	1.5	H/M	Y
14	186.8	10	2560	3120.9	986.9	46	28	10.5	1.6	H/M	Y
15	72.7	6	2520	2561.5	1045.7	25	30	8.2	1.6	H/M	Y
16	23.3	4	1234	1533.9	767.0	15	41	9.7	2.5	H/M	Y
17	334.9	16	1188	1851.2	462.8	45	30	5.5	0.8	M	
18	689.8	25	7739	3840.5	768.1	121	25	7.2	0.7	H/M	Y
19	529.4	24	8066	10283.7	2099.2	105	25	7.8	0.8	H/M	Y
20	287.9	14	1952	4646.9	1241.9	52	31	8.6	1.2	H/M	Y
22	153.6	9	431	482.8	160.9	35	29	9.2	1.6	L	
23	140.1	8	2185	1358.8	480.4	39	50	7.4	1.2	M	
24	256.3	13	1408	5076.6	1408.0	5	20	2.7	1.2	L	
25	45.2	5	0	-	-	0	-	-	-	L	
26	119.1	7	129	150.5	56.9	14	41	9.7	2.6	L	
27	471.0	22	3998	4723.0	1006.9	105	28	8.5	0.8	H/M	Y
28	153.6	8	4130	5810.5	2054.3	32	23	8.3	1.5	H/M	Y
29	256.3	13	11331	10454.0	2899.4	64	30	7.2	0.9	H/M	Y
30	352.0	17	9707	10313.9	2501.5	75	23	6.0	0.7	H/M	Y
31	519.7	24	8527	10084.7	2058.5	120	24	7.9	0.7	H/M	Y
32	116.9	8	10641	10309.3	3644.9	40	32	9.1	1.4	H/M	Y
33	245.6	13	925	2497.5	692.7	33	20	6.4	1.1	L	
34	652.5	29	1156	2400.4	445.7	84	23	7.4	0.8	M/L	Y
35	646.2	29	4004	5084.7	944.2	122	23	6.7	0.6	H/M	Y
36	123.5	8	1329	1321.1	467.1	25	35	10.0	2.0	H/M	Y
37	210.0	11	2614	2393.3	721.6	47	18	6.1	0.9	M	Y
38	228.0	12	10513	8155.7	2354.3	60	29	8.3	1.1	H/M	Y
39	176.9	10	5900	7577.2	2396.1	38	30	6.7	1.1	H/M	Y
40	54.6	5	851	926.2	414.2	25	38	11.5	2.3	M	
41	15.8	4	10	20.0	10.0	5	37	5.7	2.5	L	
42	55.0	2	60	84.9	60.0	1	50			L	
43	349.9	16	2680	3590.8	897.7	60	33	8.2	1.1	M	
44	95.4	7	4317	9539.6	3605.6	28	28	7.0	1.3	M	
46	117.1	8	955	1005.7	355.6	32	34	13.2	2.3	M	
47	212.4	11	12894	14303.9	4312.8	50	23	4.6	0.7	H/M	Y
48	260.1	13	8729	7558.8	2096.4	64	29	8.7	1.1	H/M	Y
49	295.9	15	2894	3303.4	852.9	70	27	8.4	1.0	H/M	Y
50	109.5	5	1378	1361.1	608.7	23	32	7.3	1.5	H/M	Y
51	114.0	8	1501	1678.4	593.4	40	21	5.5	0.9	H/M	Y

Key: Block = Block ID number; Acres = Acres of susceptible forest (all types); Plots = Total plots completed in lock;
SD = Standard deviation, SE = Standard error; Mort. Risk = Mortality risk: H - High; M- Moderate; L - Low; Def. 99
=Defoliation in 1999 (Y=yes).

Appendix 2. Summary of Cuyahoga Valley NRA Gypsy Moth Public Scoping and Outreach: 1999-2000

Representatives from Cuyahoga Valley National Recreation Area participated in a variety of gypsy moth-related scoping activities in 1999-2000. These included community meetings and open houses that were hosted by surrounding communities, meetings with other agencies, and a scoping letter requesting input on management options. These activities are detailed below.

<u>Date</u>	<u>Activity</u>
June 24, 1999	Public Meeting. Hosted by the Village of Peninsula at the Peninsula Public Library, attended by 100+ people. Question and Answer period.
July 7, 1999	Cuyahoga Valley Communities Council Meeting. Held at the Brecksville Community Center. Discussions with representatives from many municipalities and federal and state agencies.
July 14, 1999	Open House. Hosted by Sagamore Hills Township at the Sagamore Hills Safety Center. A Gypsy Moth Task Force comprised of 20 individuals from federal, state and county agencies and local residents was developed under the auspices of the Cuyahoga Valley Communities Council.
August 17, 1999	Gypsy Moth Task Force Meeting. Held at the Brecksville Community Center. Updates on surveys and other issues of concern.
August 23, 1999	Planning Meeting. Cuyahoga Valley NRA. Meeting with the USDA Forest Service, Cleveland Metroparks, Metro Parks Serving Summit County, and the Ohio Dept. of Agriculture to discuss coordination issues and information needs.
September 9, 1999	Planning Meeting/Training. Cuyahoga Valley NRA. Meeting and training with Forest Service to design and implement egg mass survey plan.
September 28, 1999	Gypsy Moth Task Force Meeting. Held at the Brecksville Community Center. Updates on surveys and other issues of concern.
December 2, 1999	Gypsy Moth Task Force Meeting. Held at the Brecksville Community Center. Updates on surveys and other issues of concern.

- January 13, 2000 **Gypsy Moth Planning Meeting.** Cuyahoga Valley NRA. Meeting with Forest Service and Ohio Dept. of Agriculture to discuss coordination and planning issues.
- January 20, 2000 **Gypsy Moth Task Force Meeting.** Held at the Brecksville Community Center. Updates on surveys and other issues.
- March 1, 2000 **Notice of Availability.** Ads announcing the availability of the draft environmental assessment for public review are placed in local newspapers (The Plain Dealer & Akron Beacon Journal). Approximately 180 press releases announcing this were mailed out to local media the previous week. The EA is also placed on the Cuyahoga Valley NRA web pages.
- March 1, 2000 **Public Meeting.** Held at the Richfield Fellowship Hall. Public meeting to discuss the treatment proposals of the Ohio Dept. of Agriculture and the National Park Service. The Cuyahoga Valley NRA draft environmental assessment is announced for 30-day review.
- March 2, 2000 **Public Meeting.** Held at the Brecksville Community Center. Public meeting to discuss the treatment proposals of the Ohio Dept. of Agriculture and the National Park Service. The Cuyahoga Valley NRA draft environmental assessment is presented for review.

A scoping letter detailing the gypsy moth issue at Cuyahoga Valley NRA and requesting input was sent to the following agencies and organizations:

Animal Protection Institute
 Cleveland Metroparks
 The Fund For Animals
 Greater Akron Audubon Society
 The Humane Society of the United States
 In Defense of Deer
 Metro Parks, Serving Summit County
 Ohioans for Animal Rights
 Ohio Department of Natural Resources – Division of Natural Areas and Preserves
 Ohio Department of Natural Resources – Division of Parks and Recreation
 Ohio Department of Natural Resources – Division of Wildlife
 Ohio Environmental Protection Agency
 Sierra Club - Portage Trail Group
 U.S. Environmental Protection Agency
 U.S. Fish & Wildlife Service

Appendix 3. Alternative 2 Gypsy Moth Treatment Area, 2000 - Cuyahoga Valley National Recreation Area, Ohio.

Appendix 4. Alternative 3 Gypsy Moth Treatment Area, 2000 - Cuyahoga Valley National Recreation Area, Ohio.

Appendix 5. Butterfly Species List for Cuyahoga Valley National Recreation Area (USDI, National Park Service 1999b).

	<u>Common Name</u>	<u>Scientific Name</u>	<u>Habitat</u>
1	Acadian Hairstreak	<i>Satyrrium acadicum</i>	wetlands
2	American Copper	<i>Lycaena phlaeas americana</i>	old fields
3	American Painted Lady	<i>Vanessa virginiensis</i>	open areas
4	Baltimore	<i>Euphydryas phoeton</i>	fens, open areas
5	Banded Hairstreak	<i>Satyrrium calanus falacer</i>	oak forest
6	Black Dash Skipper	<i>Euphyes conspicuus</i>	fens, open areas
7	Black Swallowtail	<i>Papilio polyxenes</i>	old fields
8	Buckeye	<i>Junonia caenia</i>	open areas
9	Cabbage White	<i>Pieris rapae</i>	open areas
10	Clouded Sulphur	<i>Colias philodice</i>	open areas
11	Cloudy Wing	<i>Thorybes sp.</i>	oak forest margins
12	Comma	<i>Polygonia comma</i>	deciduous forest
13	Common Wood Nymph	<i>Cercyonis pegala F.alope</i>	open areas
14	Coral Hairstreak	<i>Harkenclenus titus</i>	open areas
15	Delaware Skipper	<i>Atrytone delaware</i>	open areas
16	Dun Skipper	<i>Euphyes vestris metacommet</i>	open areas
17	Dusted Skipper	<i>Atryonopsis hianna</i>	open areas
18	Eastern Tailed blue	<i>Everes comyntas</i>	open areas
19	Eastern Tiger Swallowtail	<i>Papilio glaucus</i>	deciduous forest
20	Edwards' Hairstreak	<i>Satyrrium edwardsii</i>	oak savanna
21	European Skipper	<i>Thmelicus lineola</i>	open areas
22	Fiery Skipper	<i>Hylephila phyleus</i>	open areas
23	Great Spangled Fritillary	<i>Speyeria cybele</i>	open forests
24	Hoary Edged Skipper	<i>Achalarus lyciades</i>	open areas
25	Horace's Duskywing	<i>Erynnis horatius</i>	oak forest
26	Indian Skipper	<i>Hesperia sassacus</i>	grassy fields
27	Juvenal's Duskywing	<i>Erynnis juvenalis</i>	oak forest
28	Least Skipper	<i>Ancyloxpha numitor</i>	open areas
29	Leonard's skipper	<i>Hesperia leonardus leonadus</i>	open areas
30	Little Glassy Wing	<i>Pomeius verna</i>	old fields
31	Little Wood Satyr	<i>Megisto cymela</i>	shaded habitats
32	Meadow Fritillary	<i>Boloria bellona</i>	open areas
33	Milbert's Tortoise Shell	<i>Nymphalis milberti</i>	mesic woods
34	Monarch	<i>Danaus plexippus</i>	open areas
35	Mourning Cloak	<i>Nymphalis antiopa antiopa</i>	deciduous forest
36	Northern Broken Dash	<i>Wallengrenia egeremet</i>	old fields
37	Northern Cloudywing	<i>Thorybes pylades</i>	oak forest margins
38	Northern Golden Skipper (Hobomok)	<i>Poanes hobomok hobomok</i>	forest margins
39	Orange Sulphur (Aalfalfa Butterfly)	<i>Colias eurytheme</i>	open areas
40	Painted Lady	<i>Vanessa cardui</i>	open areas
41	Pearl Crescent	<i>Phyciodes tharos</i>	open areas
42	Peck's Skipper	<i>Polites coras</i>	open areas
43	Question Mark	<i>Polygonia interrogationis</i>	deciduous forest
44	Red Admiral	<i>Vanessa atalanta rubria</i>	mesic woods
45	Red Spotted Purple	<i>Limnitis arthemis astyanax</i>	deciduous forest
46	Sachem Skipper	<i>Atalopedes campestris huron</i>	open areas
47	Silver Spotted Skipper	<i>Epargyreus clarus clarus</i>	clover, alfalfa

48	Silvery Blue	<i>Glaucopsyche lygdamus</i>	wood vetch
49	Silvery Checkerspot	<i>Chlosyne nycteis</i>	open areas
50	Sleepy Duskywing	<i>Erynnis brizo</i>	oak forest
51	Spicebush Swallowtail	<i>Papilio troilus</i>	deciduous forest
52	Spring Azure	<i>Celastrina ladon complex</i>	deciduous forest
53	Striped Hairstreak	<i>Satyrium liparops</i>	open forests
54	Summer Azure	<i>Celastrina sp.</i>	deciduous forest
55	Viceroy	<i>Limenitis archippus archippus</i>	open areas
56	White Admiral	<i>Basilarchia arthemis arthemis</i>	deciduous forest
57	White-m Hairstreak	<i>Parrhasius m-album</i>	open areas
58	Wild Indigo Duskywing	<i>Erynnis baptisiae</i>	open areas
59	Zabulon skipper (Southern Golden)	<i>Poanes zabulon</i>	open forests

Appendix 6. Compliance documents.